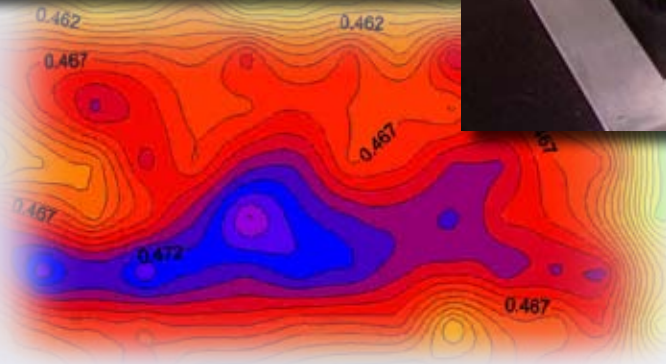
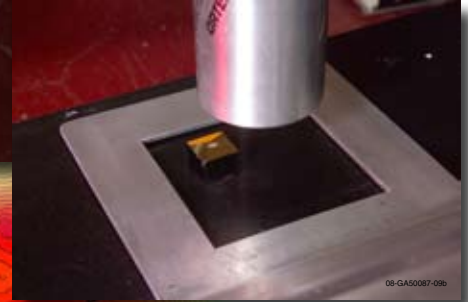


PPMS technology is used for in situ characterization of materials during formation and the subsequent cooling and heat treatment processes in a range of industrial and military materials development applications.



Portable Positron Measurement System (PPMS)

Materials scientists have long been confronted by a mystery. What happens to the material properties of steel, metal alloys, glass and ceramics, semiconductors, even plastics and composites when they undergo phase changes (liquid to solid)? How do materials respond during formation and subsequent heat treatment?

The Portable Positron Measurement System (PPMS) unveils this mystery. This technology is used for in situ characterization of materials during formation and the subsequent cooling and heat

treatment processes in a range of industrial and military materials development applications.

An automated measurement system that is designed for factory use, PPMS actually measures sub-nano structures of a material in situ, including the changes induced during the melt, solidification and subsequent heat treatment processes inside a furnace or oven at temperatures up to 1,600 C. This ability to quantify changes in material properties to within 0.1 percent in high-temperature and dynamic environments is a long-sought path to a true

understanding of processes used to make everything from steel and exotic alloys to composite aircraft components and computer chips.

No other technology can directly monitor melt, solidification and heat treatment processes for metallic and nonmetallic materials in situ during the actual formation process. Only PPMS can do this by using positron annihilation to quantitatively measure both the microstructure of a material and the changes in strain or dislocation density

Continued next page

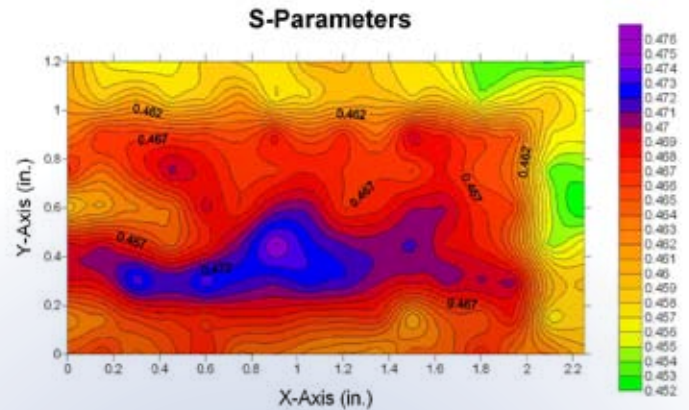
The Energy of Innovation

Continued from previous page

that affect material properties through the entire formation process. PPMS provides critical, real-time information on heat treatment and induced stress that is not available from any other nondestructive testing (NDT) technology.

Ideal for use in a range of industrial and military materials development and quality assurance applications, PPMS functions in areas where current NDT technology fails to provide critical information. Conventional NDT approaches are largely empirical and have little ability to prescribe effective fabrication changes to improve material characteristics.

The significant manufacturing advance is that PPMS continuously provides atomic-level information that can be



Reconstruction of a PPMS material lattice structure that can show the effect of changes in the material properties during the cooling and heat treatment processes.

acted on during fabrication to achieve optimum material results. No other NDT technique can do this; there are no direct competitors for PPMS.

PPMS enables researchers to create new materials, develop

better production processes and optimize existing processes. This powerful non-destructive testing technique offers the ability to pursue better, higher quality materials for modern products.

For more information

Technical Contacts

Douglas W. Akers
208-526-6118
douglas.akers@inl.gov

Technology Transfer Contact

Gary Smith
208-526-3780
gary.smith@inl.gov

A U.S. Department of Energy
National Laboratory



Critical elements of PPMS

- Material microstructure monitoring through the entire melt-cooling-heat treatment process** – PPMS's ability to quantify changes in material properties to within 0.1% in high-temperature and changing environments provides the ability to truly understand and influence the processes used to make everything from steel to composite aircraft.
- Designed for use in high-temperature environments** – Detector system positioned outside hot zone with a cooled source probe inside the hot zone for direct activation of the material to be monitored.
- Automated data acquisition and analysis for continuous quality assurance control** – Continuous operation and automated interface for material property assessment.
- Designed for interface and continuous feedback to manufacturing control systems** – Continuous, real-time, in situ characterization of material change-of-state (solid/liquid/solid/heat treatment), with feedback interface to the production process.
- Easy-to-use interface for operator use with minimal training** – All aspects of the system are fully automated for both system operational control and the processes being measured.
- Low product cost and maintenance** – With an initial price of about \$60,000 and an estimated \$2,000 per year for maintenance, PPMS costs far less than most quality assurance instrumentation and systems.
- Designed for use in production environments** – Fully automated for immediate use by an operator or automated operation for continuous use.